Crowdsourcing the Robin Hood effect in cities

Maxime Lenormand

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Joint work with

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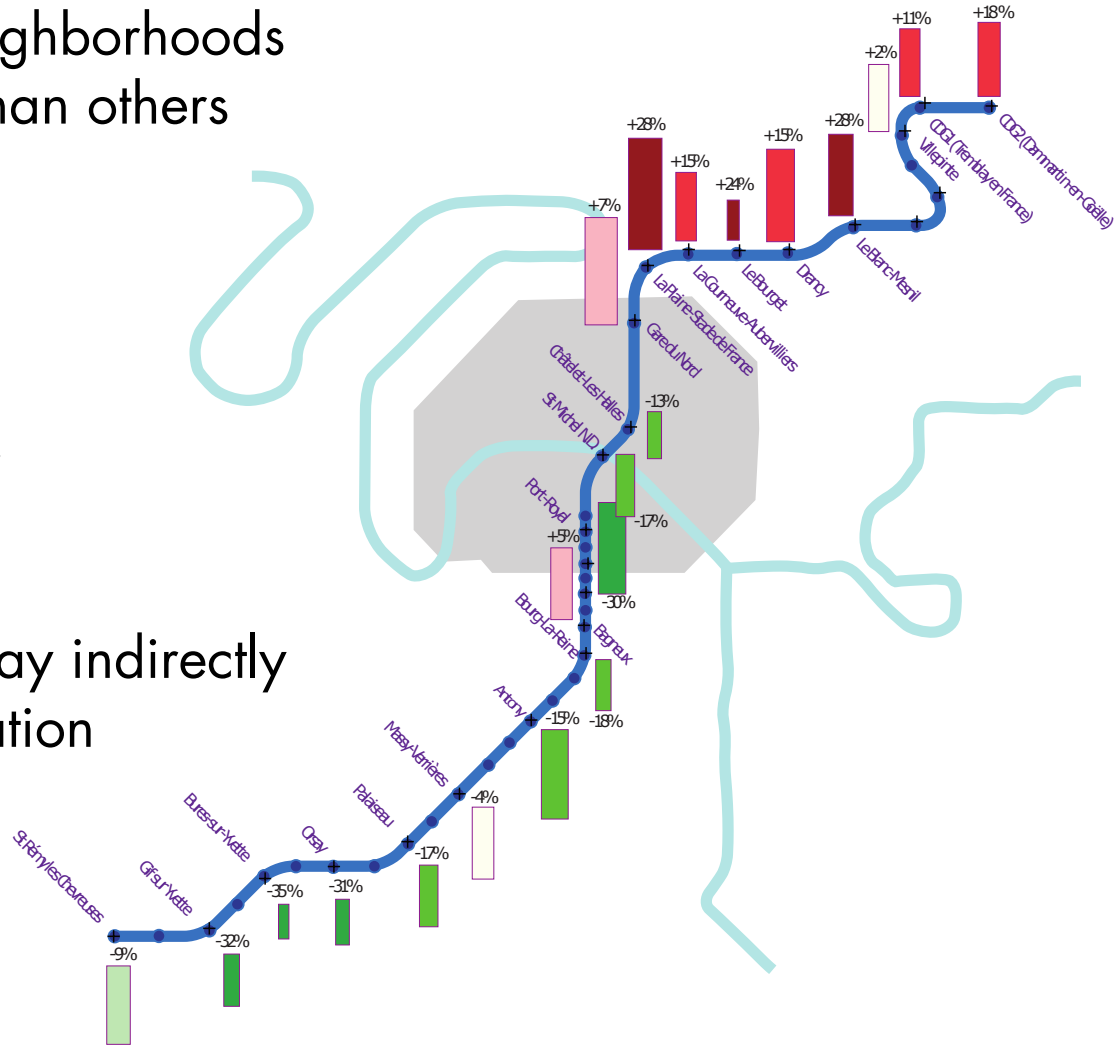
Spatial inequality in the city

- In any city there are some neighborhoods that are significantly poorer than others

- Strong inequalities have harmful consequences

  → ***Neighborhoods effect***

- Fostering comercial activity may indirectly benefits to the resident population
  - Job opportunities;
  - More transport;
  - Increased safety…



Redistribution through shopping mobility

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Idea

Shopping trips can be a vector of wealth redistribution among neighborhoods

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Idea

Shopping trips can be a vector of wealth redistribution among neighborhoods

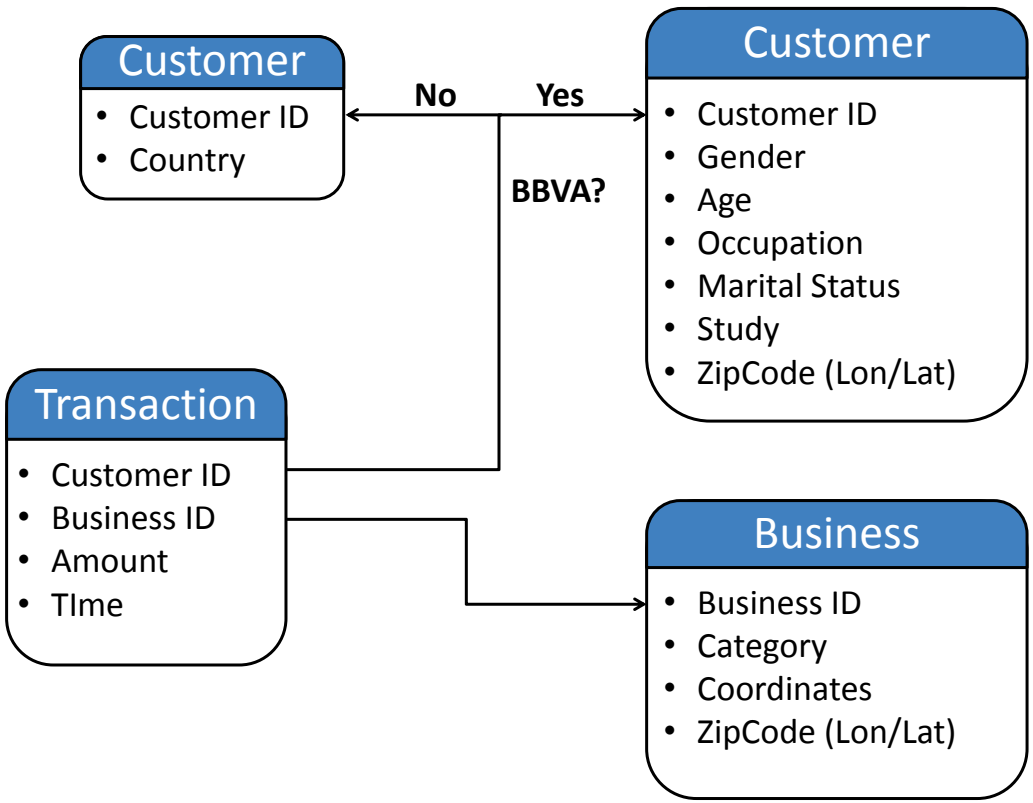
Question

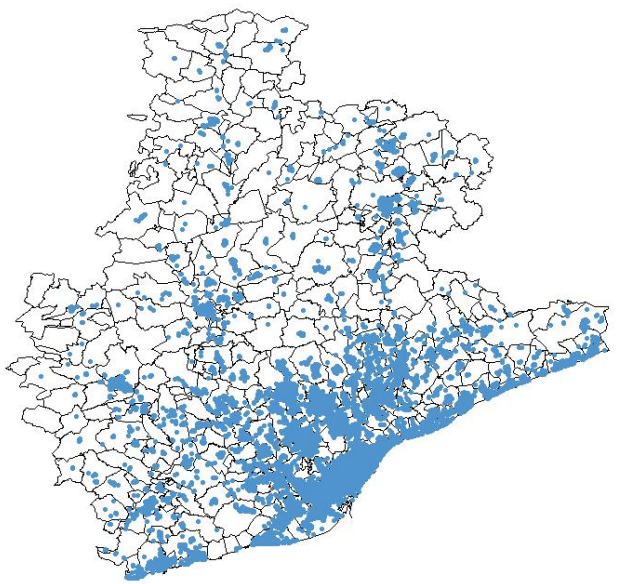
What fraction of shopping trips should be redirected toward alternative businesses, located in other neighborhoods, in order to rebalance buinesses income among neighborhoods?

BBVA database

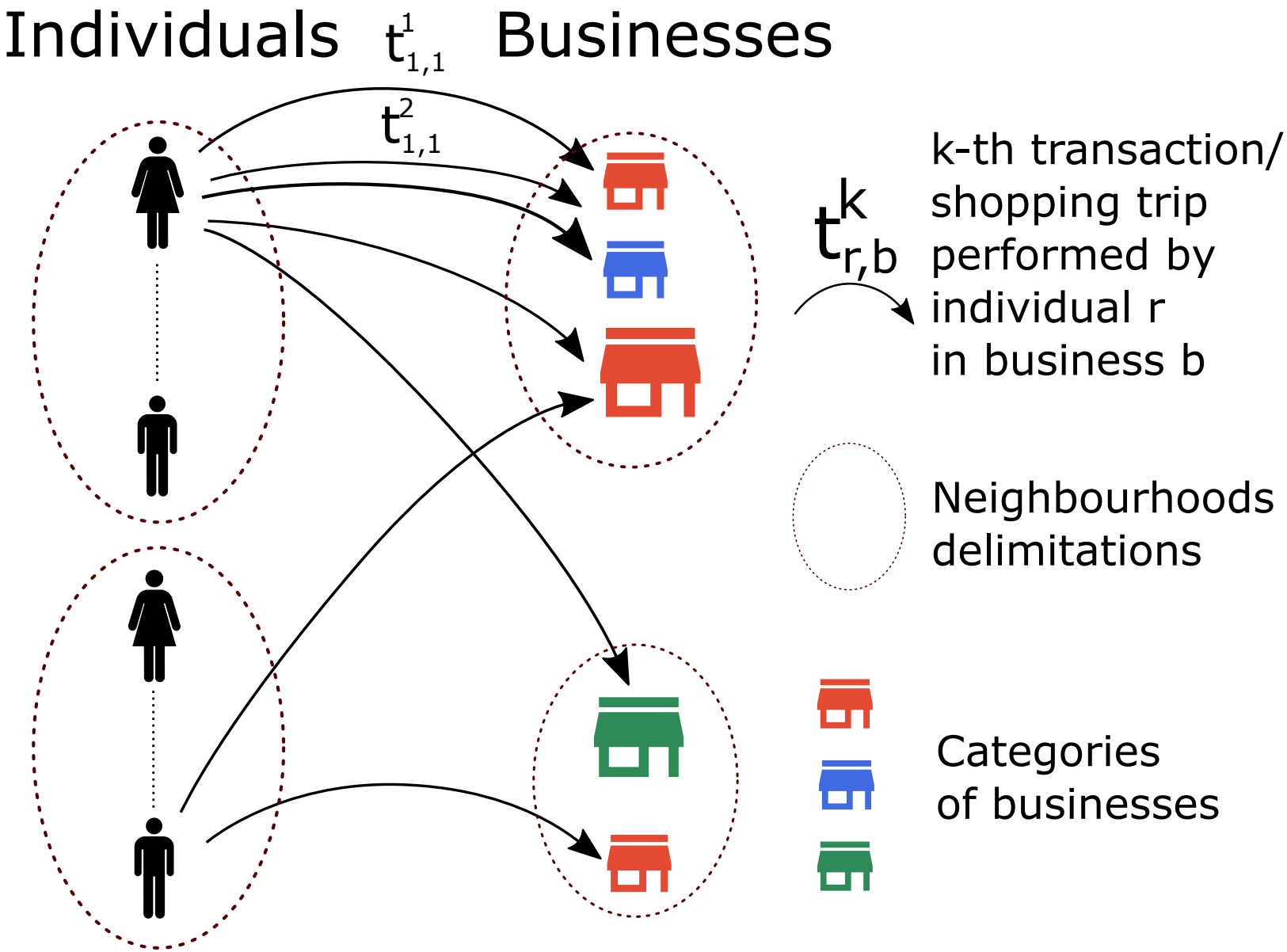
Provinces of **Madrid** (~6M inhab.) and **Barcelona** (~5M inhab.)

130M of transactions made in **2011/2012** by **3.5M of customers**
in **320,000 businesses** classified in **80 categories**

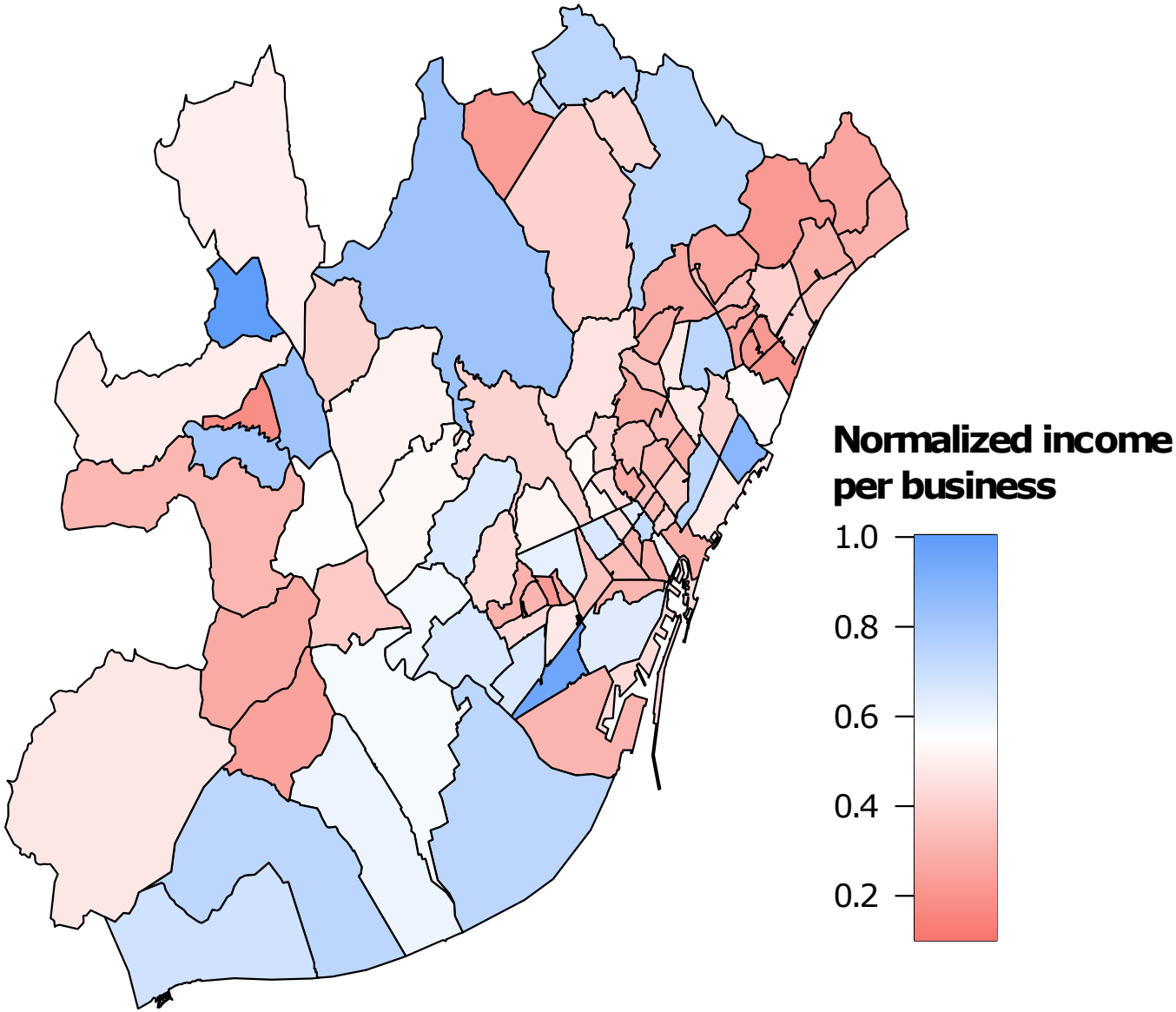




Bipartite network of shopping trips



Spatial distribution of business income

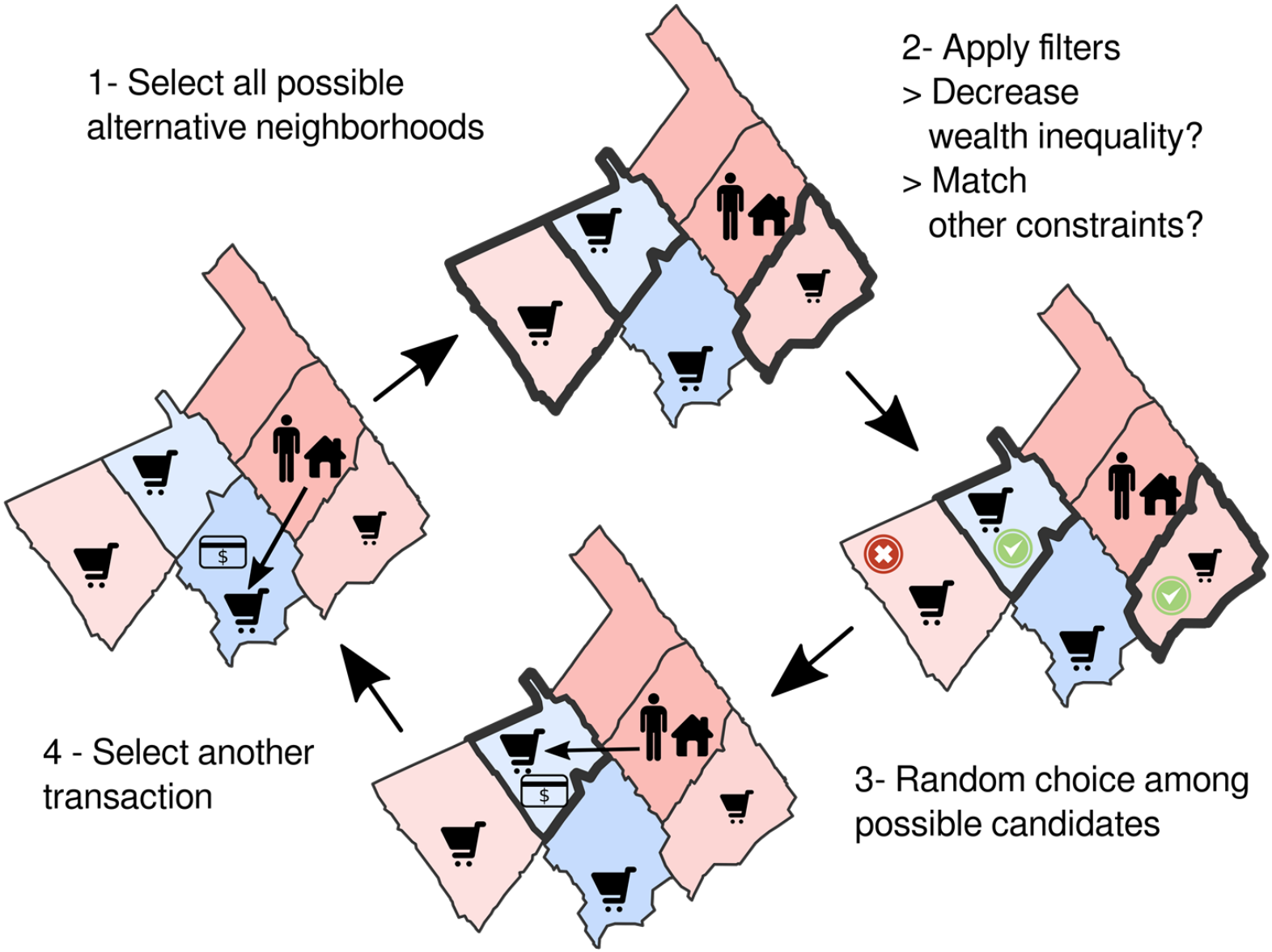


Three other key aspects

In addition to the spatial distribution of business income and its distance to the egalitarian situation **W**, we also take into consideration:

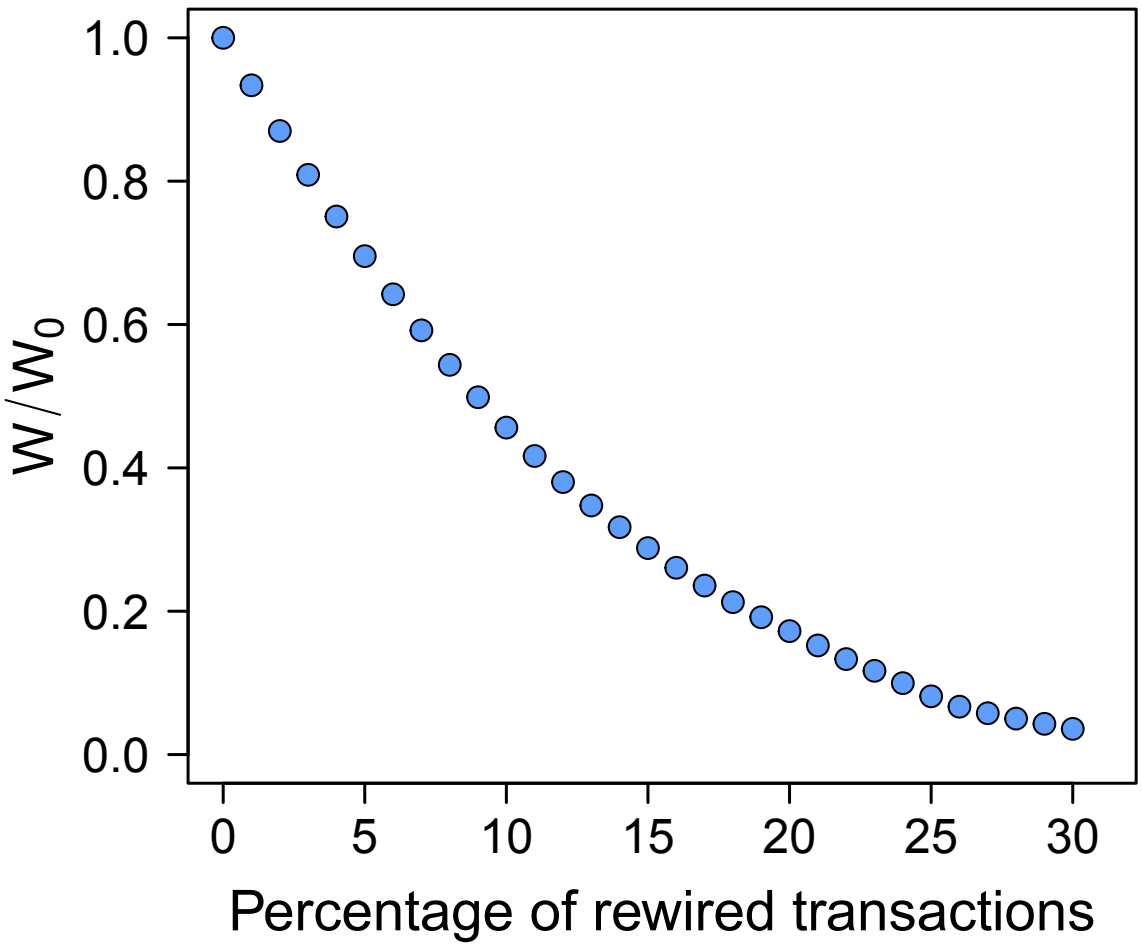
- The distance traveled **D**
- The spatial routines of individuals ρ
- The spatial mixing of individual residing in different part of the city, evaluated as the distance to a "fully mixed city" **S**

Rewiring method



Reachability of the solution…

…while preserving the other key aspects



→ **Wealth inequalities between neighborhoods are reduced by 95%**

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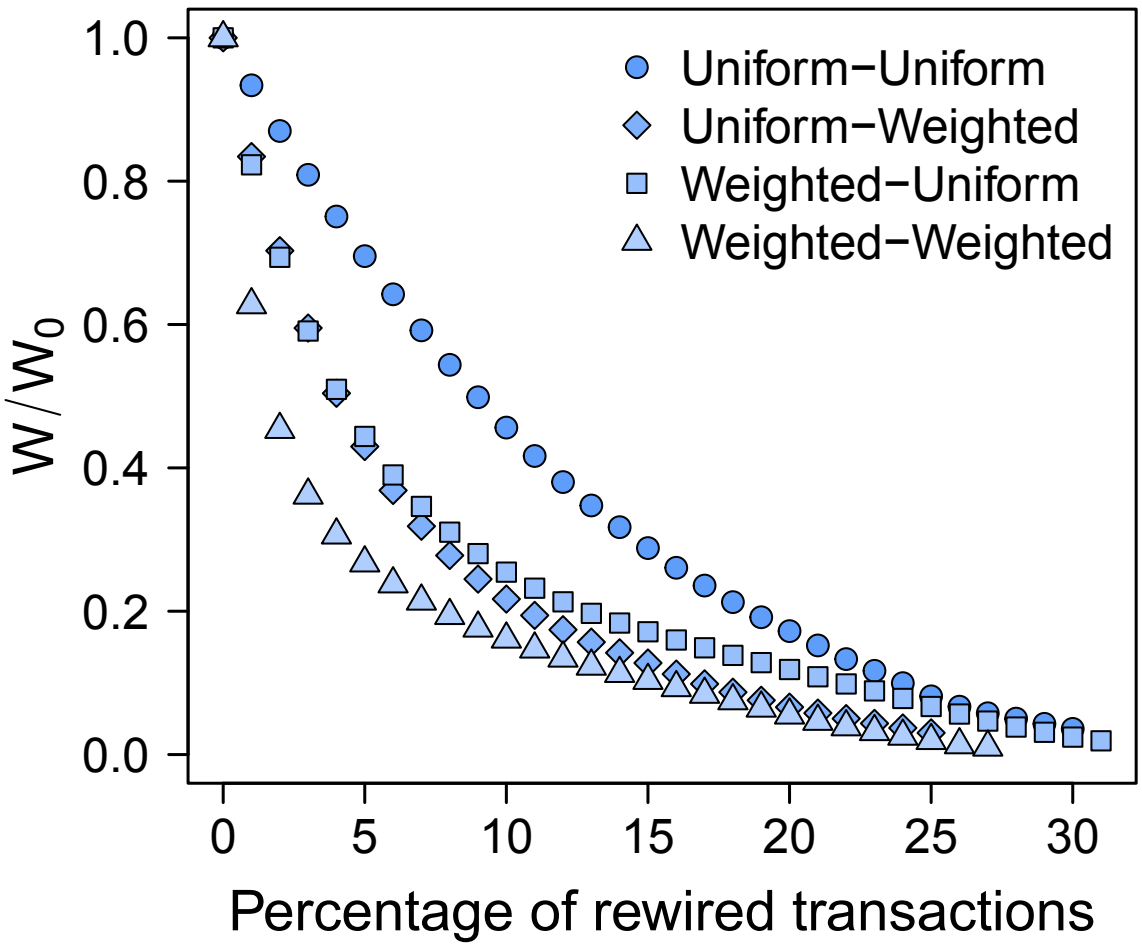
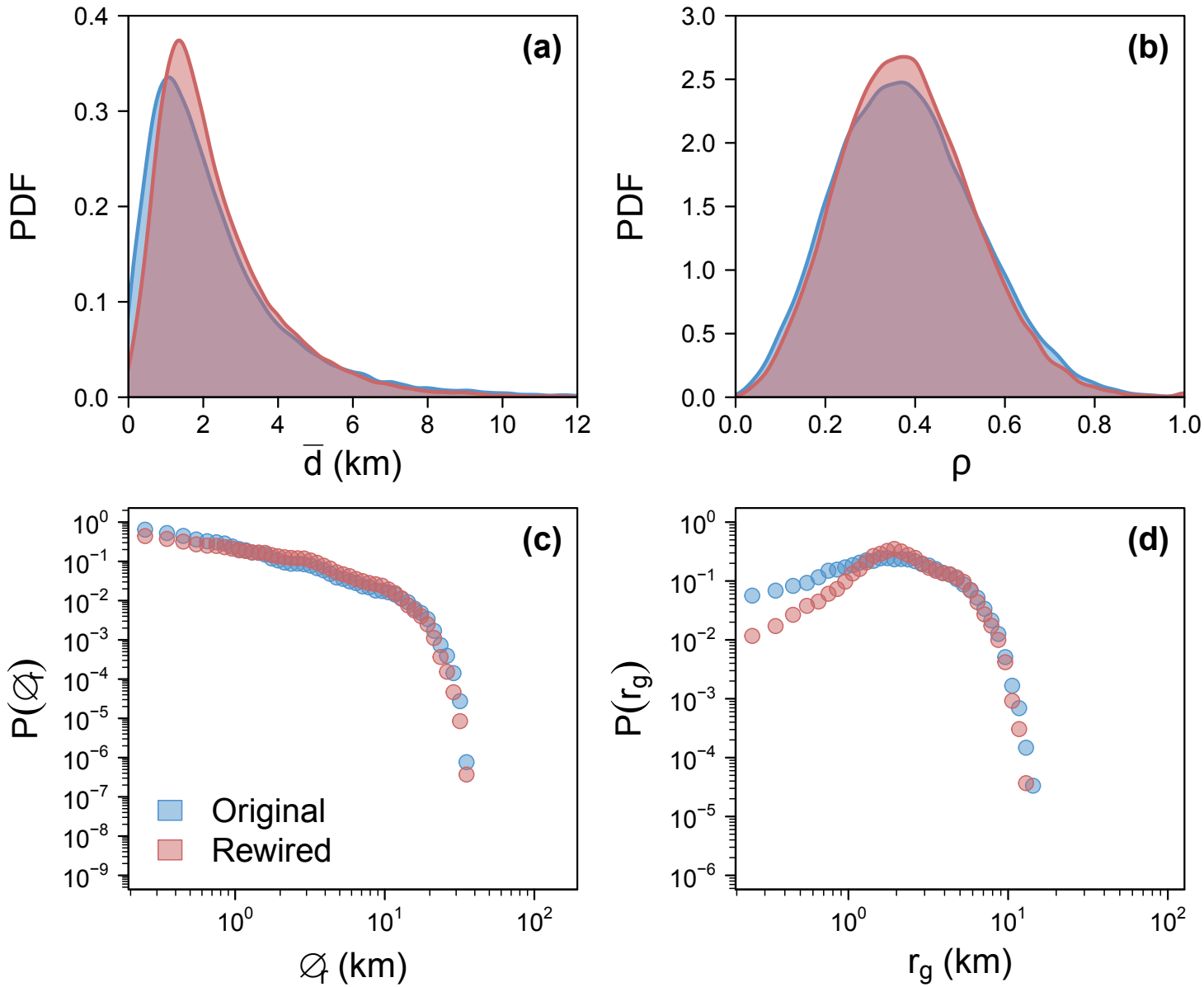


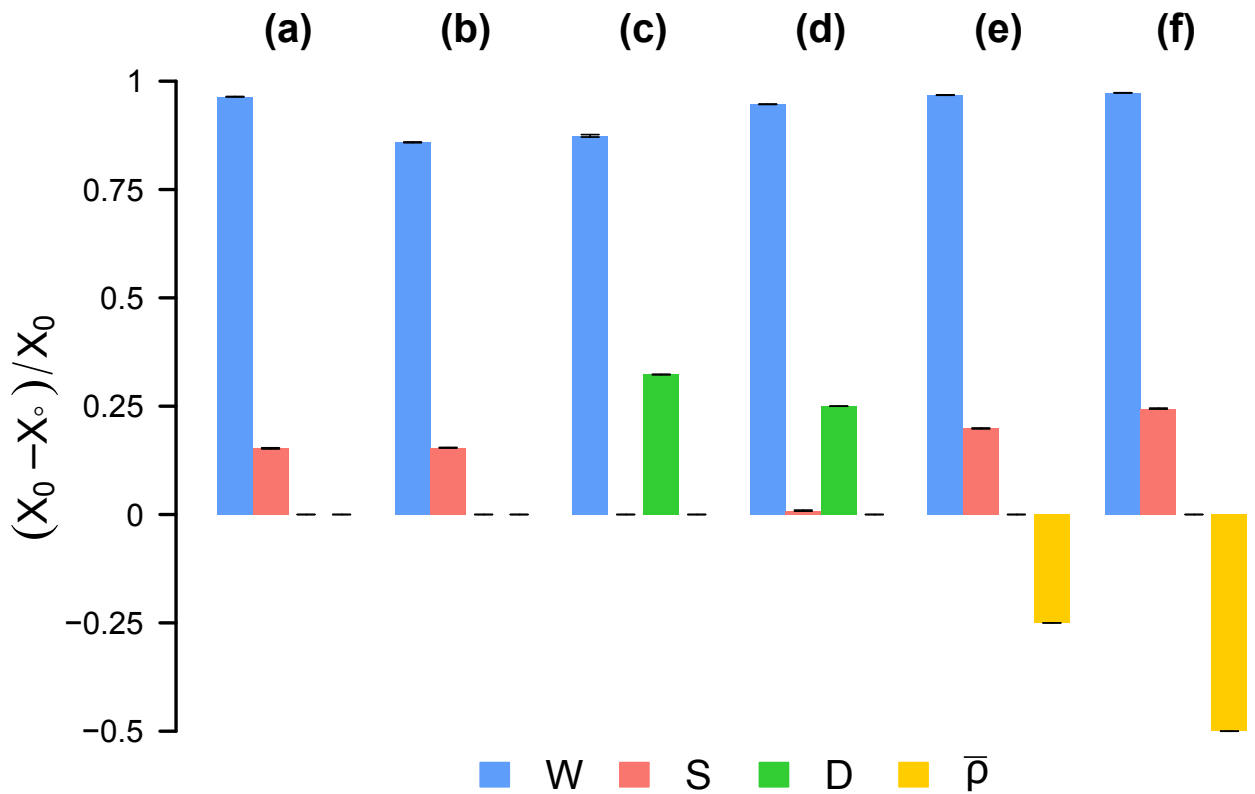
Many possible rewiring methods, the "clever" methods perform better

Individual human mobility patterns



Multi-criteria improvement of shopping mobility

Experiment	α_W	α_S	α_D	$\alpha_{\bar{\rho}}$	W (B/M)
(a) Reference	0	1	1	1	96.4%/99.5%
(b) Spatial mixing ↑	0	0.75	1	1	85.9%/78.1%
(c) 50% energy savings	0	1	0.5	1	87.4%/84.8%
(d) 25% energy savings	0	1	0.75	1	94.7%/98.8%
(e) Exploration rate ↑	0	1	1	1.25	96.8%/99.9%
(f) Exploration rate ↑↑	0	1	1	1.5	97.3%/100%



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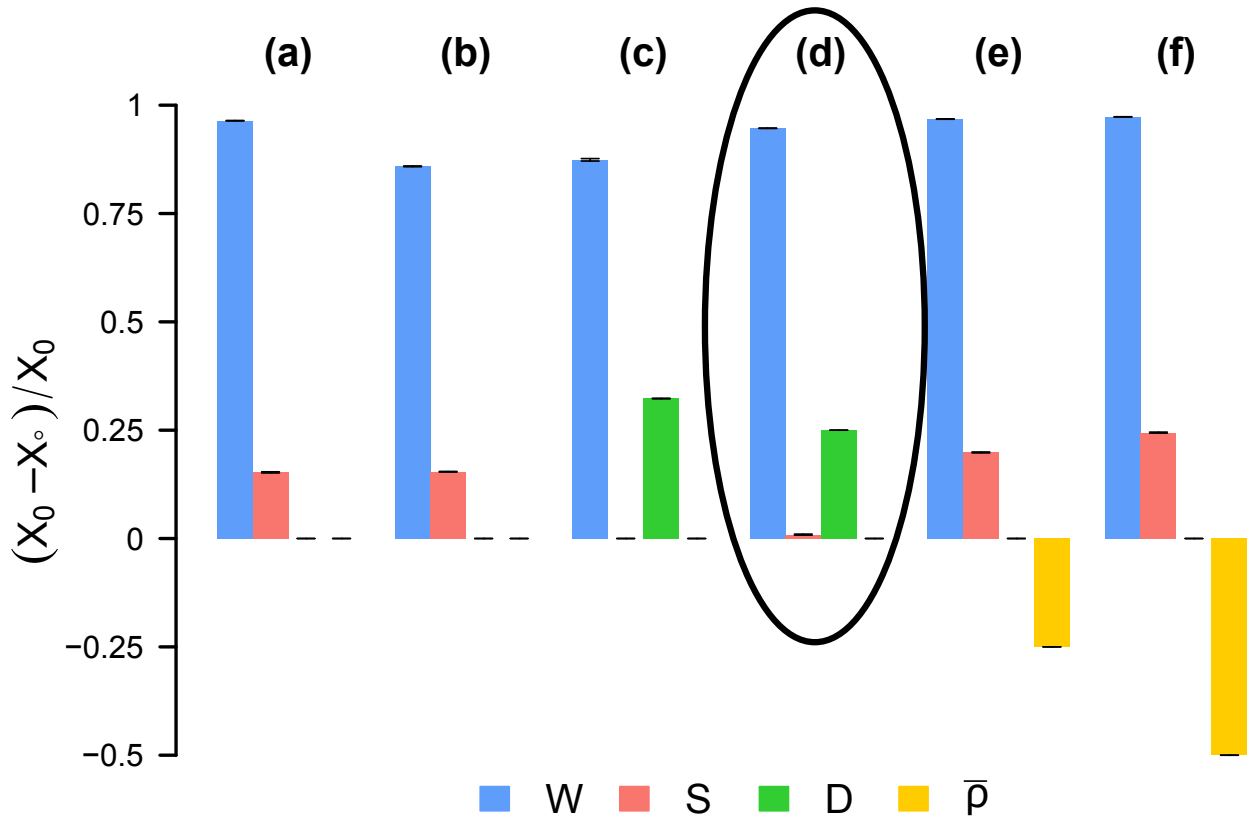

Take home messages

- **Rewiring ~10 % of all individual shopping trips might result in a 80+ % decrease of business income inequality among neighborhoods, in Barcelona and Madrid**

- Situations where ICT data bypass top-down planning policies and foster distributed, bottom-up approaches of city-scale hard problems

- Urgent need to relate ICT data to social equity and spatial justice and such apps would rejuvenate the very meaning of the so-called « sharing economy »

Acknowledgement

Network analysis in Social Sciences and Humanities